Size Effects on the Thermophysical Properties of Thermoelectrical Materials

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Size effects on thermophysical properties in thermoelectrical materials have been investigated in sintered Bi_2Te_3 particles. Since the size effects involve changes in the density of states and phonon softening, it is anticipated that the physical parameters of the Seebeck coefficient S, electrical conductivity s and thermal conductivity k would be altered in nanostructured materials. The efficiency of TE materials, determined by the dimensionless figure of merit $ZT = (S^2s/k)T$, should also be modified by changing the size of the materials. The sintered particles of P-type Bi_2Te_3 prepared by ball milling with particle size ~0.1£gm- 20£gm were fabricated and investigated. The thermal conductivity k is decreased in nano-sized Bi_2Te_3, whereas no noticeable change in thermoelectric power S is observed. In order to study the quantum size effects on thermoproperties in the nano-size regime, smaller particles are prepared by fabrication methods of electric sparking and thermal evaporation; experiments on thermoproperties in these nano-sizes specimens will be reported.